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(71) Applicant: CARGNEL, Gianangelo

I-32100 Belluno (IT)

(72) Inventor: CARGNEL, Gianangelo

I-32100 Belluno (IT)

(74) Representative: Zavattoni, Maria Chiara et al
Racheli & C. S.p.A.Viale San Michele del Corso, 4
20144 Milano (IT)

(54) A protective barrier for arresting falling rocks, having a sack-type retaining net anchored to top and bottom cables

(57) A protective barrier (10) for arresting falling rocks comprises uprights (11) pivotally mounted on a plinth (11a) and anchored to the ground by means of downstream bracing cables (16) and upstream bracing cables (14). A top cable (12) connects the tops of the uprights to one another and a bottom cable (13) connects

the ground anchorages of the upstream bracing cables to one another. Cross cables (15) connect each of the tops of the uprights to an anchorage of an upstream bracing cable of an adjacent upright. A net (20) is linked to the top cable and to the bottom cable and is disposed and can rest on the cross cables, upstream of the uprights.

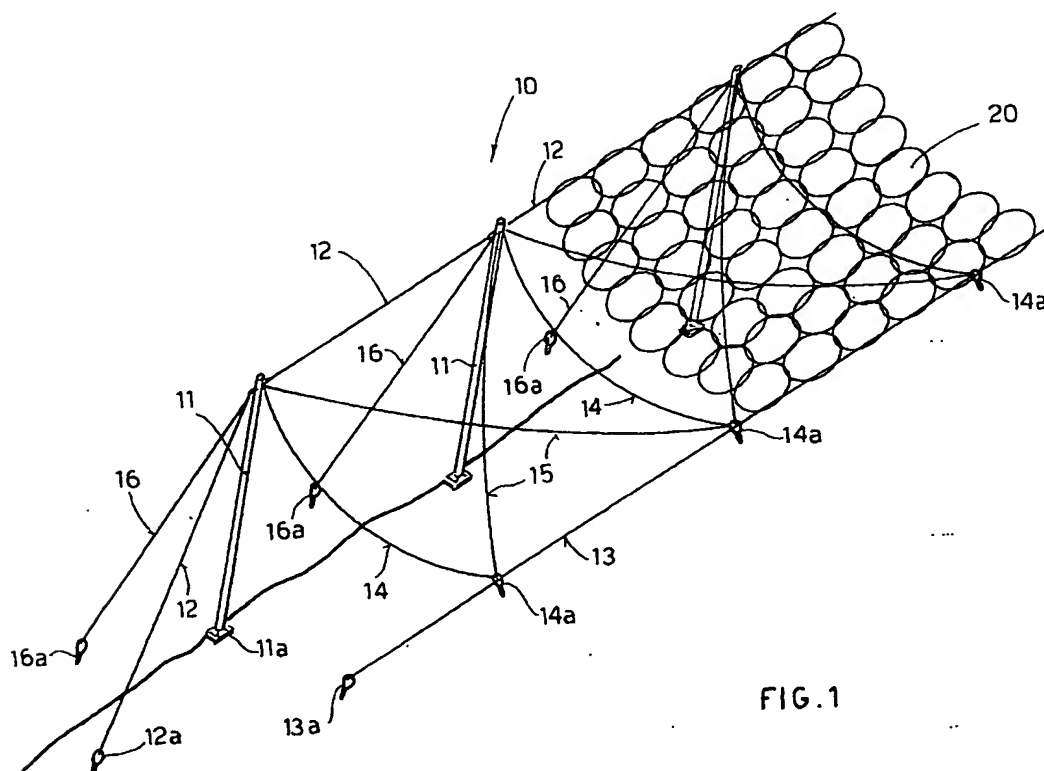


FIG. 1

Description

[0001] The invention refers to the field of protective barriers for arresting falling rocks, as currently widely used on slopes to protect inhabited areas, constructions, and portions of road networks, against falling stones, earth or rocks in general.

[0002] A wide variety of forms of protective barriers against falling rocks are known to the art, among which is a structure forming the subject matter of prior patent No. IT-1184798 by the same applicant.

[0003] The objects of this application are to reduce the investment costs for a protective barrier against falling rocks and to enable easier assembly thereof.

[0004] These objects are achieved with a protective barrier as stated in claim 1. Further advantageous characteristics will be apparent from the dependent claims.

[0005] The new barrier comprises a plurality of uprights, each pivotally mounted with a foot thereof on a respective plinth and stayed by means of bracing or windbracing cables anchored to the ground, in particular a downstream windbracing cable and one or more upstream windbracing cable for each upright. A top cable or rope extends through the tops of the uprights and is anchored to the ground at the ends thereof and a bottom cable or rope extends through the ground anchorages of the upstream windbracing cables. Cross or transverse cables are preferably provided between adjacent upstream windbracing cables, and more precisely between the tops of each upright and the anchorage of an upstream windbracing cable of an adjacent upright.

[0006] The "sack-type" net is secured to the top cable and to the bottom cable and extends above the upstream windbracing cables and the cross or transverse cables.

[0007] The new barrier has lower production and assembly costs with respect to the majority of existing barriers and is easier to mount.

[0008] According to a further characteristic, the uprights of the new barrier have threaded through holes at various heights, possibly with welded plate reinforcements, so that the top cable can be stretched at a uniform height even in the event of a difference in height between the plinths or bases of the upright.

[0009] Exemplary unrestrictive embodiments of the barrier will be described with reference to the appended drawings in which:

- Figure 1 is an axonometric view of a new barrier, a net thereof is only partially illustrated;
- Figure 2 is a side elevational view of the barrier, from the left in Figure 1;
- Figure 3 is an elevational view of the barrier, seen from the downstream side;
- Figure 4 is a top plan view of the barrier, the upstream side is drawn in the upper part of the drawing;
- Figure 5 is a view of the detail A circled in Figure 3,

enlarged with respect to said figure;

- Figure 6 is a broken-away from elevational view of a variant of a barrier according to the invention;
- Figure 7 is a broken-away top plan view of the barrier of figure 6, the upstream portion is drawn in the upper part of the drawing;
- Figure 8 is a broken-away axonometric view of the barrier of figure 6 and 7, as seen from above and from the upstream side.

[0010] A protective barrier for arresting falling rocks according to the invention is referenced 10 as a whole and comprises a plurality of spaced uprights 11, each erected on a base or plinth 11_a in the ground, to which it is joined by means of a cardanic system known from the said previous patent. Each upright 11 is held erect by means of bracing or windbracing cables, of which an upstream cable is referenced 14 and a downstream cable is referenced 16. Each windbracing cable extends from the top of the upright to a respective anchorage, referenced 14a for cable 14 and 16a for cable 16, of a conventional type, driven into the ground.

[0011] A top cable or rope 12 extends substantially horizontally through the tops of a plurality of uprights 11 and is anchored to the ground at its ends by means of anchorages 12a.

[0012] A bottom cable or rope 13 extends through substantially aligned anchorages 14a of the windbracing cables 14, and has its ends preferably anchored to the ground by means of anchorages 13a.

[0013] Cross or transverse cables 15 each extends from the top of a respective upright 11 to the anchorage of an upstream windbracing cable 14 of an adjacent upright 11, so that two cables 15, arranged crossed over, extend between two upstream windbracing cables 14. The cable portions that cross over can be left free or connected to one another, through means that allow reciprocal sliding thereof.

[0014] A retaining net 20 disposed "bag-like" or "sack-like" is integrally secured with its upper edge to the top cable 12 and with its lower edge to the bottom cable 13. The central body of the net is then placed over the cables 14 and 15 as is better seen in Figure 2 and can rest thereon. The net 20 is preferably, but not necessarily, a chainlink net. The cables can be provided with per se known shock-absorbing systems 18, per se known from previous patent IT 1184798.

[0015] When rocks fall along the ground, the assembly reacts elastically, retaining them on the net 20, without them being able to damage the uprights or other parts of said assembly.

[0016] Furthermore, according to the invention, the top cable 12, which extends through the head of the upright, is received inside tube-shaped or cone-shaped devices 22, locked in the head of the upright.

[0017] A plurality of said holes 24 are preferably provided at different heights in the head of the upright, so that the operator who mounts the protective barrier

against falling rocks can choose on a case by case basis to apply the devices 22 in the hole 24 at the most suitable height. The pierced area of the upright is preferably reinforced with a welded plate.

[0018] A modified embodiment of the protective barrier is shown in figures 6, 7, 8 and referenced 100 as a whole.

[0019] Elements of the protective barrier 100 which are similar to homologous elements of barrier 10 have the same reference numbers and will not be described in detail.

[0020] The barrier 100 has two upstream bracing cables 114, instead of one, for each upright. The cables 114 diverge from the top of the upright to anchorages 114a and are preferably symmetrical with respect to a vertical plane containing the upright axis and the downstream bracing cable.

[0021] Cross or transverse cables extend each between the top of an upright 11 and the anchorage 114a of a nearest bracing cable 114 of an adjacent upright 11, and may be independent from each other or restrained together at an intermediate position so to be able to slide.

[0022] A net 20 is applied as above said for the barrier 10.

Claims

1. A protective barrier for arresting falling rocks comprising: a plurality of uprights (11), each linked to the ground by means of a foot or plinth on which it is articulated and each maintained erect by means of bracing cables, of which at least one is an upstream cable (14; 114) and at least one a downstream cable (16), a net (20) mounted upstream of the plurality of uprights characterized in that it further comprises:
 - at least one top cable (12) extending between the tops of said uprights;
 - at least one bottom cable (13) extending at the feet (14'; 114') of the upstream bracing cables (14; 114);
 - the net being linked to said top cable (12) and to said bottom cable (13) and disposed above said upstream bracing cables.
2. A barrier according to claim 1, characterized in that it comprises upstream transverse or cross cables (15), arranged transversally to the aforesaid bracing cables.
3. A barrier according to claim 2, in which said transverse cables (15) are each arranged respectively between the head of an upright (11) and a foot or anchorage (14a, 114a) of a bracing cable (14; 114) upstream of an adjacent upright (11), so that at least

two cross cables (15) extend between two upstream bracing cables of two adjacent uprights.

4. A barrier according to claim 1, characterized in that said top cable (12) extends through holes in the head of the uprights and is anchored to the ground with the ends thereof.
5. A barrier according to claim 4, characterized in that the uprights comprise a plurality of through holes (24) spaced longitudinally along it, with possible welded plate reinforcement(s).
6. A barrier according to claim 4 or 5, characterized in that the top cable (12), passing through the heads of the uprights, is received within devices (22) locked in the head of the upright.
7. A barrier according to claim 2, in which at least some of said cables comprise shock-absorbing systems.
8. A barrier according to claim 3, characterized in that said cross cables (15) are connected to one another slidingly at the crossed portions thereof.
9. A barrier according to claim 1 characterized in that it comprises one upstream bracing cable (14) for an upright (11).
10. A barrier according to claim 1 characterized in that it comprises two upstream bracing cables (114) for an upright.

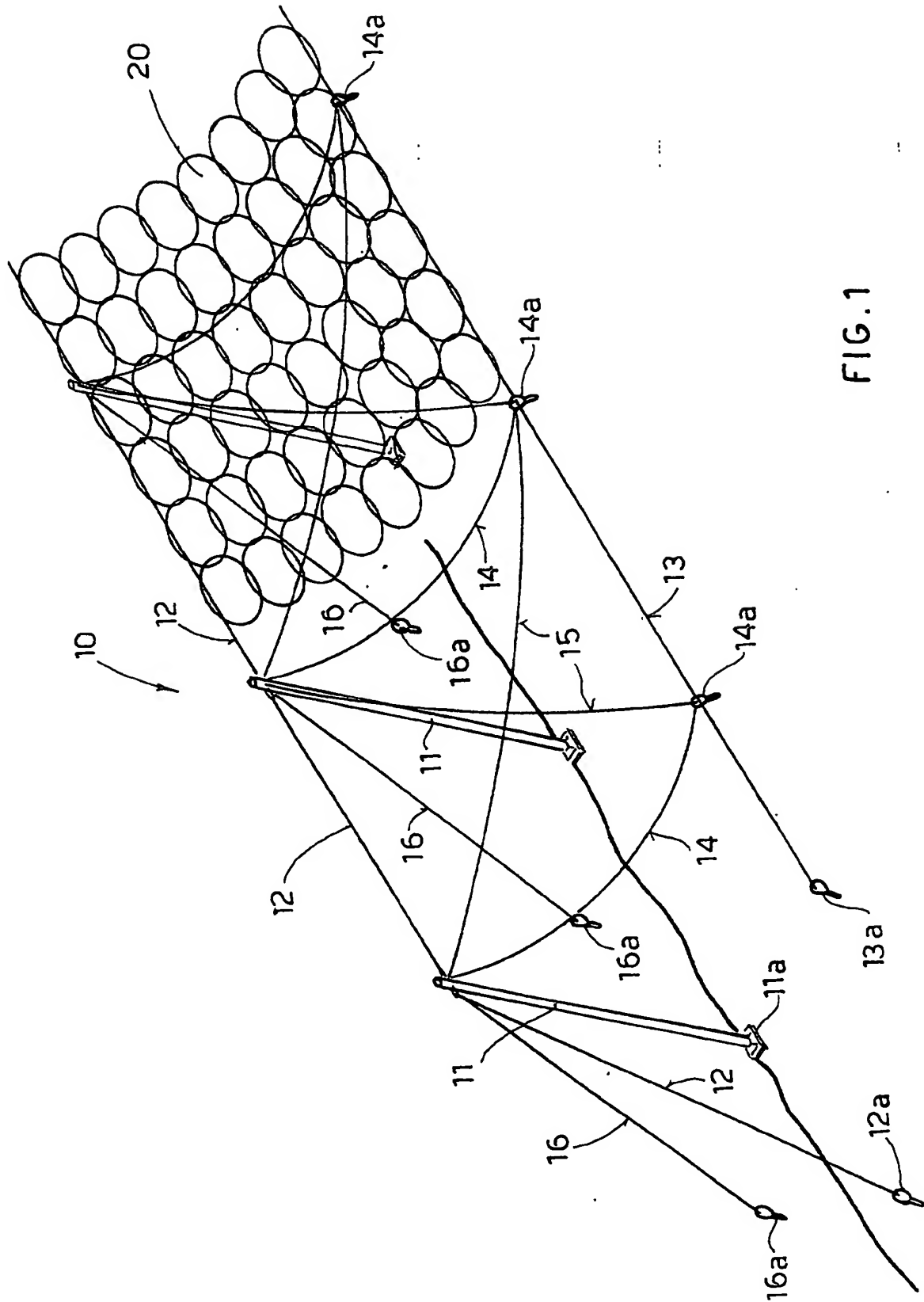


FIG. 1

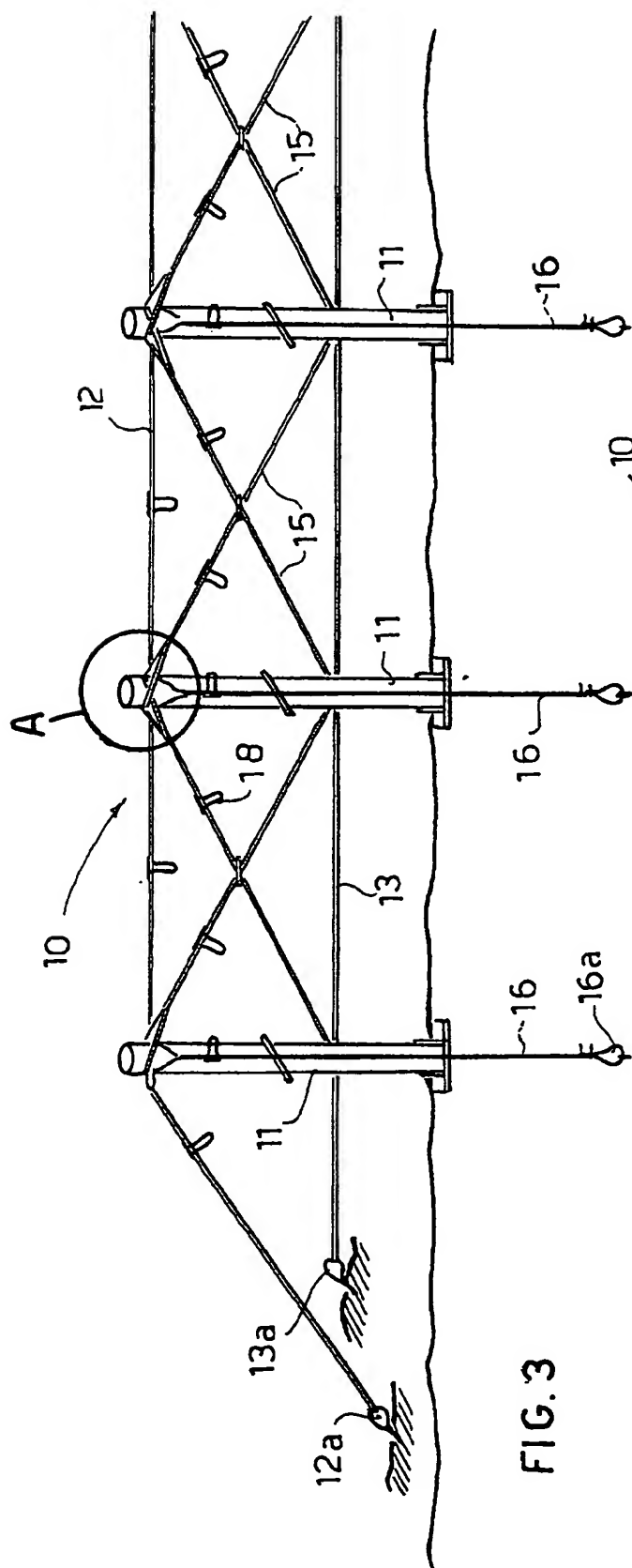


FIG. 3

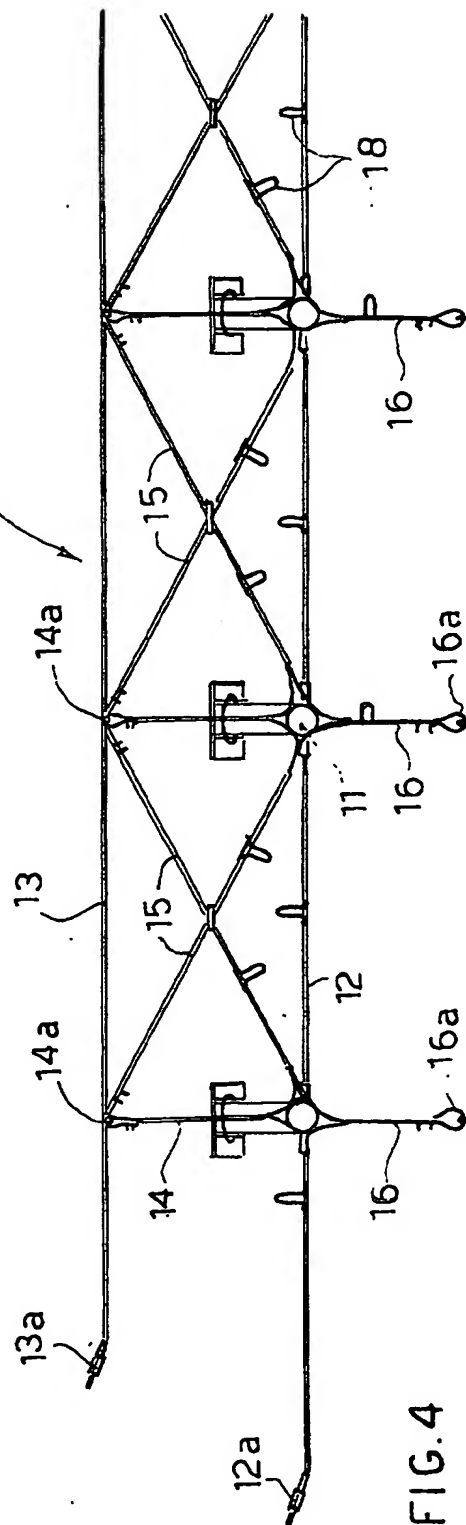
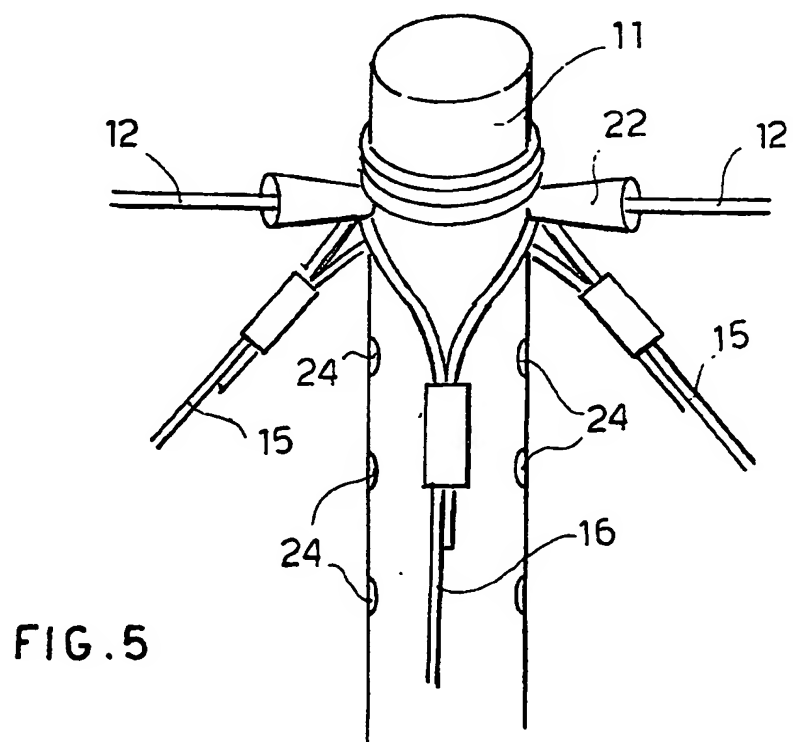
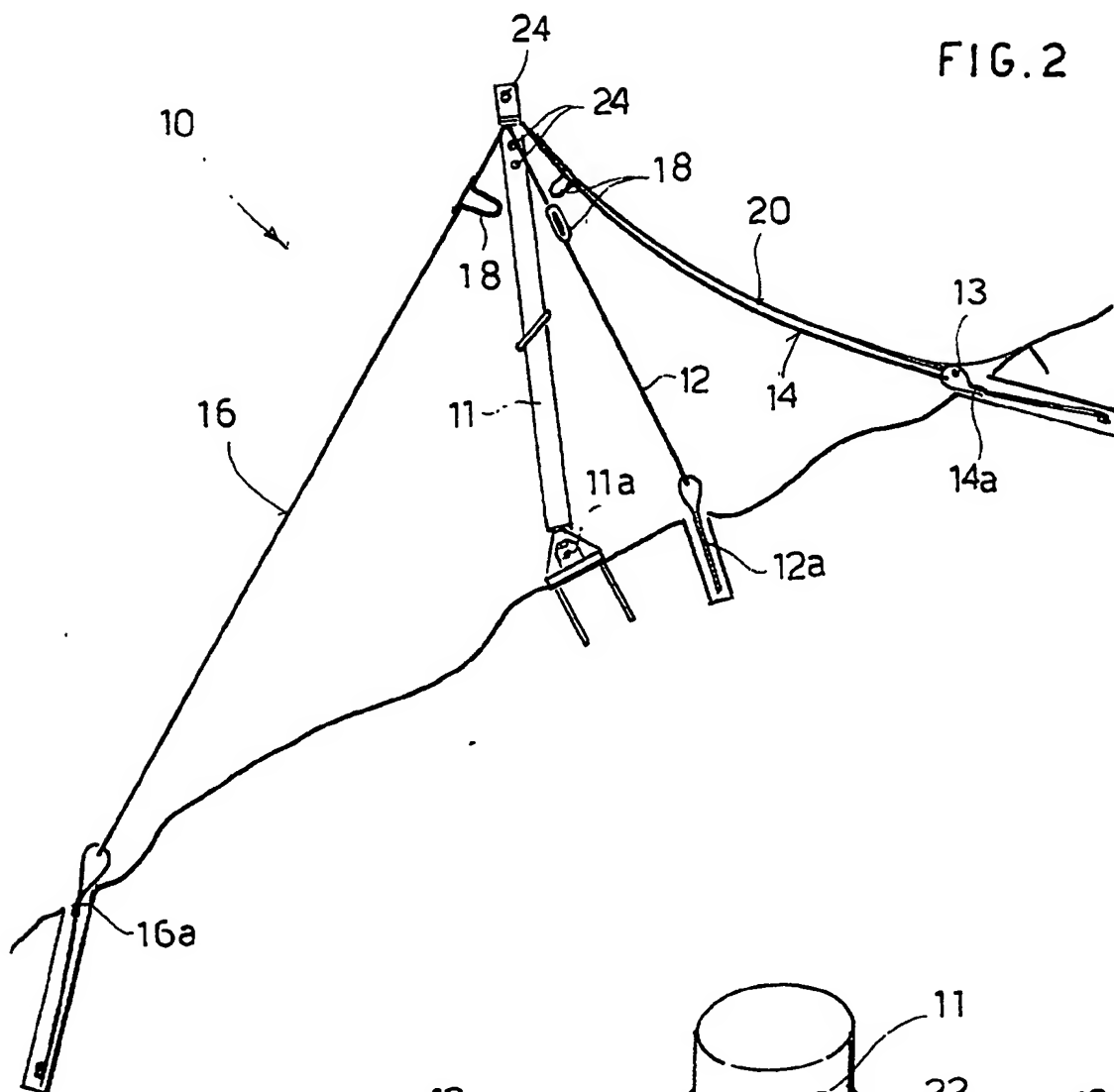
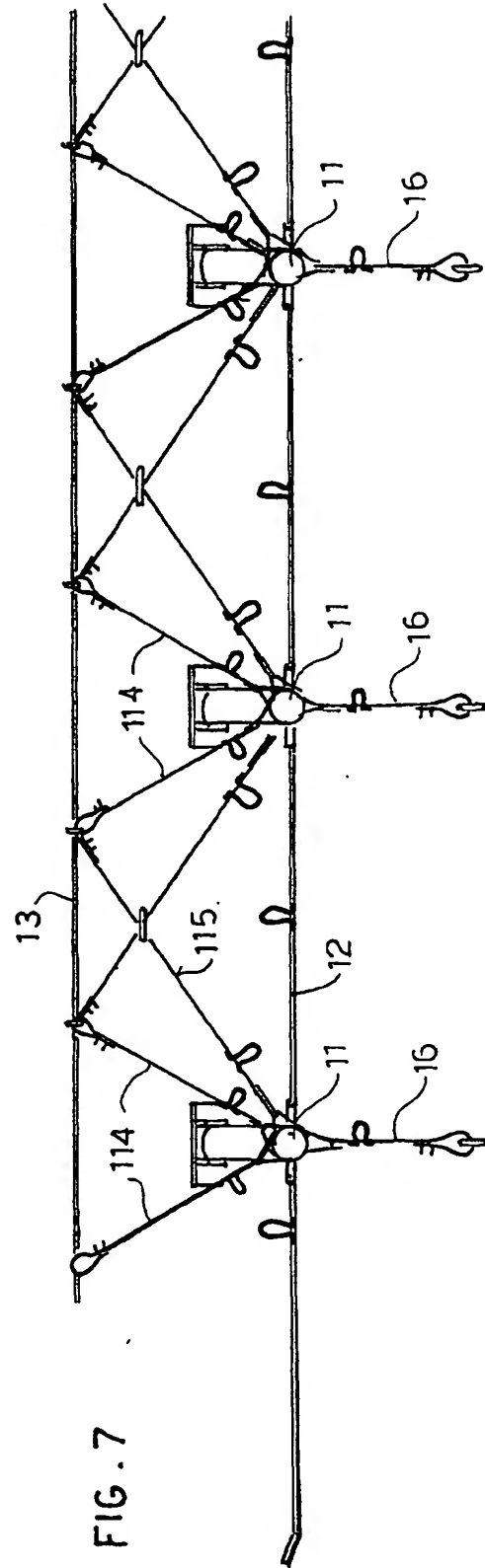
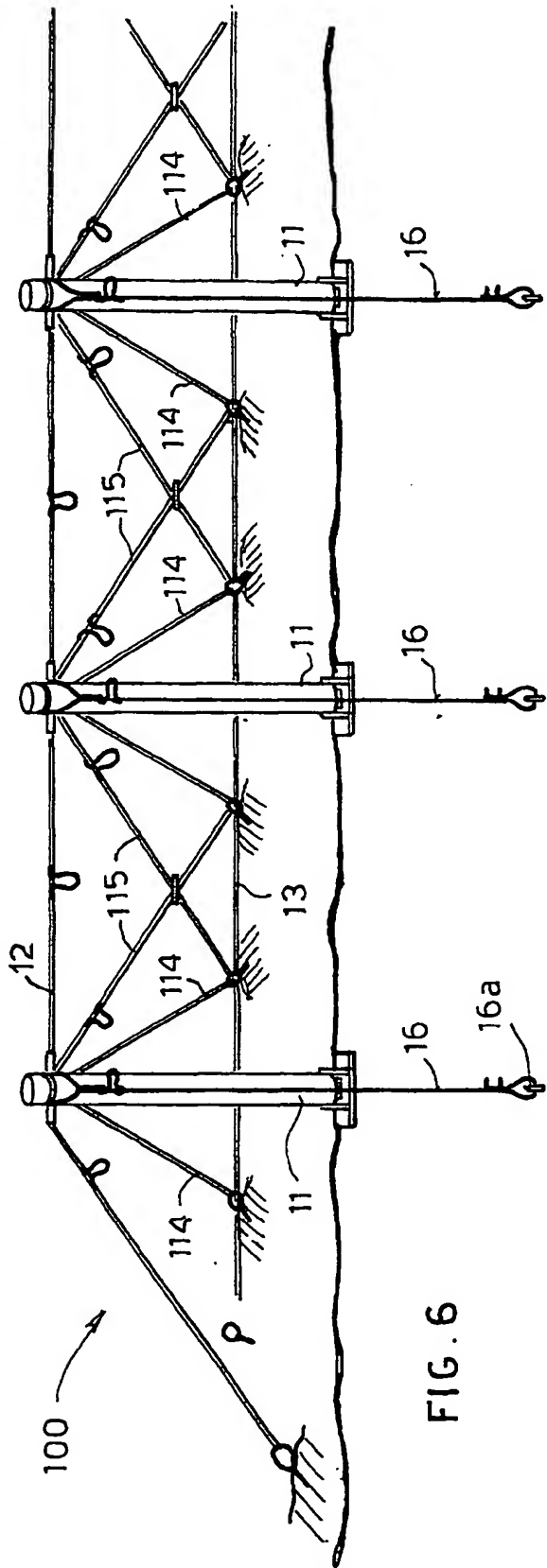
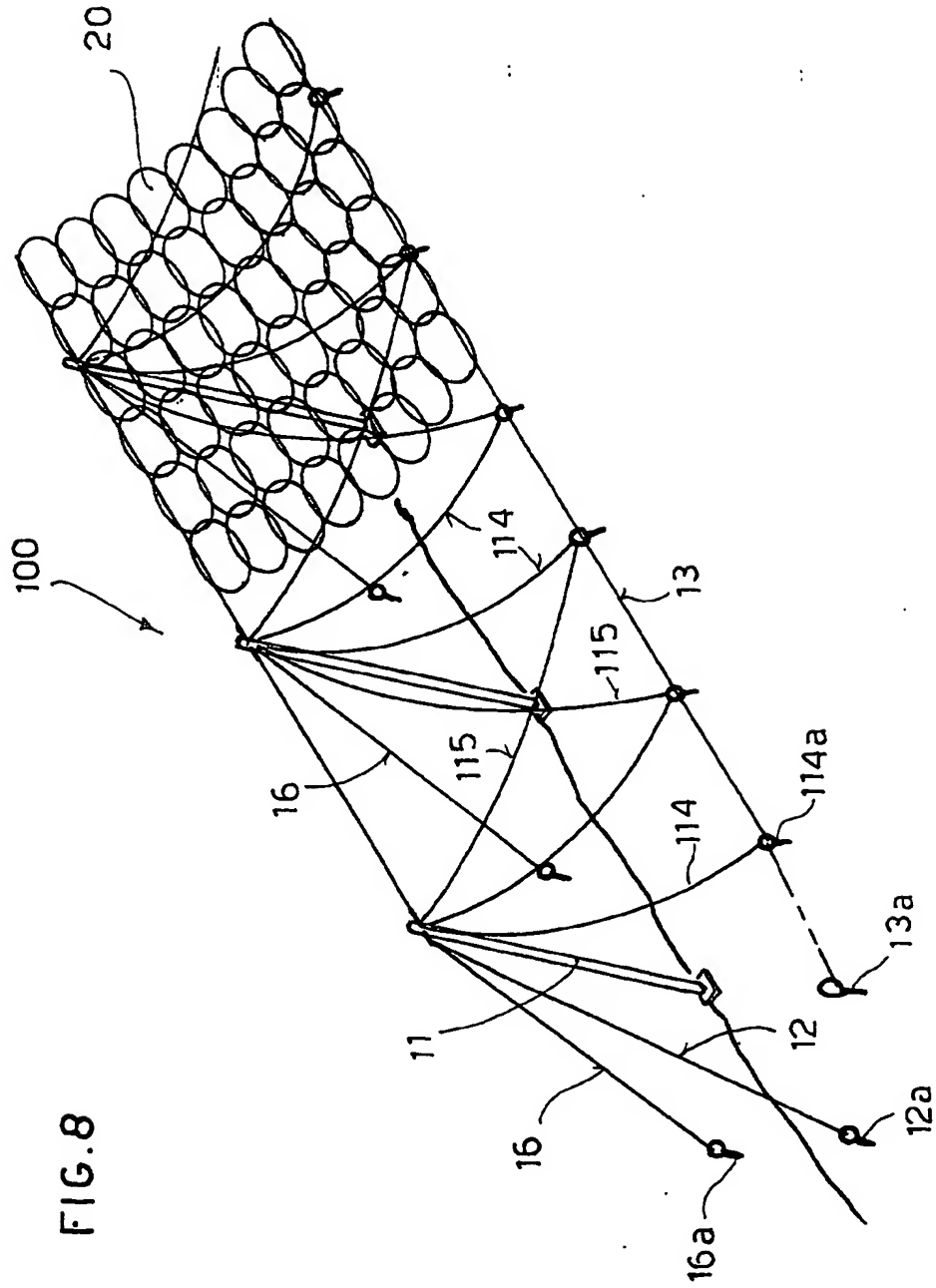


FIG. 4







(19)



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(72) Inventor: **CARNEL, Gianangelo**
I-32100 Belluno (IT)

(74) Representative: **Petruzzello, Aldo et al**
Racheli & C. S p A
Viale San Michele del Carso, 4
20144 Milano (IT)

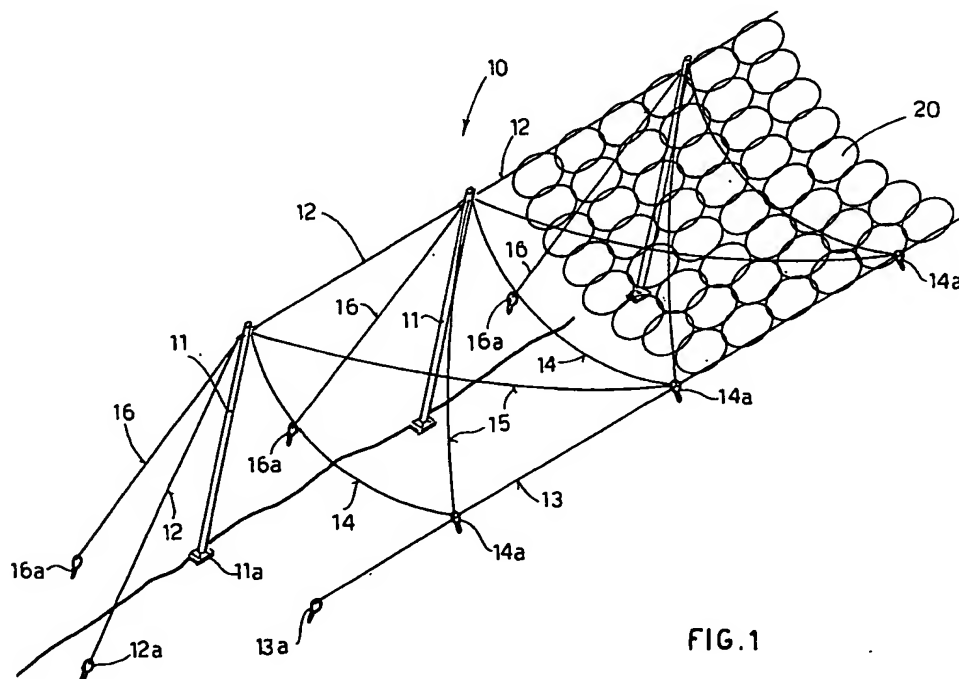
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**FIG. 1**



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 00 12 2681

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 4 July 2003	Examiner Severens, G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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